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Insight into the Issues and Challenges of Adopting More Environmental Practices on Irish Farms

Research dissertation presented in partial fulfillment of the requirements

for the degree of

MSc in Accounting and Finance Management (HETAC)

Graduate Business School, Griffith College Dublin

Moses E. Enoh

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Candidate Declaration

Candidate Name: Moses EsimEnoh

I certify that the dissertation entitled:

Insight into the Issues and Challenges of Adopting more Environmental Practices on Irish Farms

submitted for the degree of: MSc in Accounting and Finance Management (NTU) is the result of my own work and that where reference is made to the work of others, due acknowledgement is given.

Candidate signature:

Date:

Supervisor Name: Aine McManus

Supervisor signature:

Date:

Acknowledgements

I want to thank my wife and kids for being there for me throughout my studies. Their sacrifices and encouragements were second to none. My wife in particular deserves all the praises because I was virtually absent from most of the day to day activities but she was always there to fill up the vacuum.

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Finally, my immense gratitude goes to the participants of this study for their time and assistance. Their openness in expressing their opinions and thoughts on the subject matter as well as granting me access to certain information made this dissertation a reality.

Dedication

Dedicated to my wife and children for their unflinching supports throughout this level of my education

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List of Abbreviations

GHG	-	Greenhouse Gas
CO2	-	Carbon Dioxide
EU	-	European Union
US	-	United States of America
EP	-	Environmental Practices
CC	-	Climate Change

Abstract

Insight into the Issues and Challenges of Adopting more Environmental Practices on Irish Farms

Moses E. Enoh

This work is a contribution to the discussion on the environment and climate change. It concentrates on the paradox of contributing to the growth of the economy at the expense of the environment by Irish farmers. The research objectives were: to identify government policies and opportunities that exist to farmers on addressing environmental issues; to establish the problems faced by farmers on addressing environmental issues; to identify the costs faced by farmers on addressing environmental issues; to establish the costs benefit effect to farmers on adopting environmental practices; to make suggestions on some actions appropriate to addressing environmental issues by farmers. A mixed method of collecting data was used for this research. Questionnaires, case study and interviews allowed the triangulation of the disadvantages of collecting data by just one method to be overcome. A total of 55 farmers (i.e. 35 livestock and 20 tillage farmers) responded to the questionnaire, 5 interviews were conducted and a case study on a tillage farm was carried out. The study shows that lack of environmental education, lack of involving farmers into the debate and decision making and imposing environmental policies onto them makes matter even worse. Farmers do not want to be seen as the worse emitters of GHG into the environment but want to been as contributors to the growth of the economy and food providers to the growing population. Farmers do acknowledge that adopting green technology in their farms will be more beneficial but the problem they are facing is affordability. Even though minimal grants are given, it is not enough to acquire the necessary green technology and earn a living despite the long run benefits. Malthus (1798) asserted that unless population growth is checked, there will be shortage of food to feed them. However, Malthus did not foresee alternative ways of food supply which we have today. In the same line of thinking, population is growing and farmers are under immense pressure to feed this growing population of the world. If farmers do not adopt more environmental practices on their farms for a green harvest and green environment, the world would be an unsuitable place for any living creature and this will be more costly. This study did not go without some limitations. It would be a good idea if further study could be carried out with a larger sample size.

INSIGHT INTO THE ISSUES AND CHALLENGES OF ADOPTING MORE ENVIRONMENTAL PRACTICES ON IRISH FARMS

1.0 Introduction

The issues of climate change and environmental problems have been around for a long time. However, it is only in the 1960s that scientists began to recognize a series of problems, such as the rise in sea level and threat to food supplies, which are associated with global warming. Initially, the notion of climate change was, to a large extent, a myth. Nowadays, experts in the field do not only talk about the problems witnessed as a result of a rise in the sea level and the threat to food supplies, they also talk about human life threat and ecosystem degradation which has an adverse effect on agriculture. Amidst these problems faced by human race today and how to go about solving them, this research focuses on the cost benefits to Irish Farmers to adopt more environmental practices. Thus, my dissertation -*'Insight into the Issues and Challenges of adopting more Environmental Practices on Irish Farms',* looks into detail the activities that farmers are practicing that is causing this huge emission of Greenhouse gases and tries to advise on alternative ways. To effectively carry out this research and be able to draw a credible conclusion, questionnaires were sent out to farmers, case study done on a tillage farm and interviews carried out.

1.1 Research aims and objectives:

The whole notion of climate change is as a result of the rise in the level of certain gases like methane and carbon dioxide gas (CO2) in the atmosphere. CO2 gas at 15 °C and standard pressure has a density of 1.87 kg/m3. At standard pressure and 15 °C, a metric ton of carbon dioxide gas would fill a sphere 10 metres across (density of CO_2 = 1.87 kg/m³). In 2012, Ireland's greenhouse gas emissions per day was estimated to be 160,359 tonnes, with agriculture having the most emissions at 32% ((EPA), 2015). If this trend continues unchecked, there will be serious consequences sooner than later.

Visualising Ireland's Greenhouse Gas Emissions

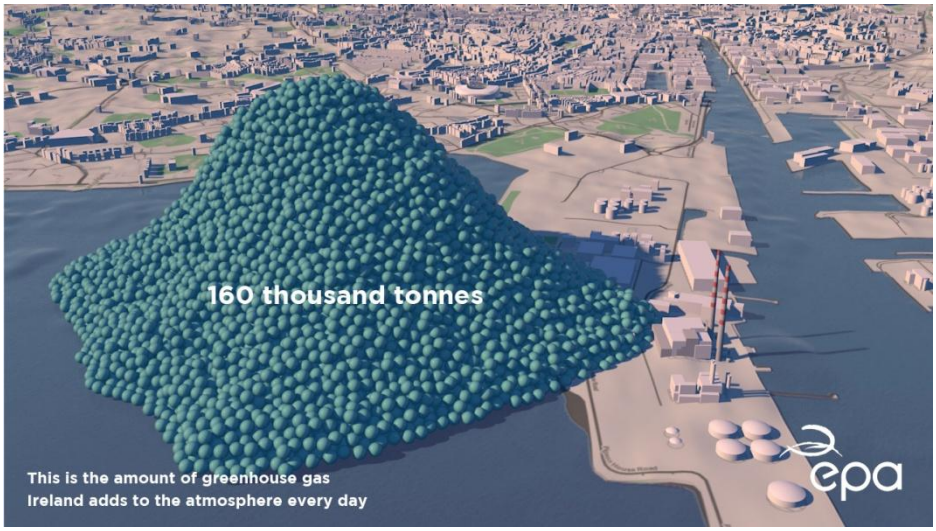

Figure 1: Source : ((EPA), 2015)

Thus the main aim of the research is to analyze and show to the Irish farmers the cost benefits of engaging in more environmental practices.

In order to develop the research objectives, it is imperative to describe the research problems which include, amongst others, finding out if there is any government policy to farmers on addressing environmental issues and the costs benefits effect to farmers on addressing environmental issues. With these in mind, the following objectives have been coined in a bid to answer the research problems:

- To identify government policies and opportunities that exist to farmers on addressing environmental issues
- To establish the problems faced by farmers on addressing environmental issues
- To identify the costs faced by farmers on addressing environmental issues
- To establish the costs benefit effect to farmers on adopting environmental practices
- To make suggestions on some actions appropriate to addressing environmental issues by farmers.

1.2 Background of research:

Environmental issues are of interest to me because the ozone layer is depleting everyday as seconds go by. This has greatly contributed to the change of climatic conditions which we all are experiencing nowadays. Knowingly or unknowingly, each citizen of the world is contributing to this depletion either directly or indirectly. However, due to the broad nature of the topic area and time being a limiting factor, focus will be on the cost benefits to Irish farmers on addressing the challenges of the environment.

With the world population growing rapidly, there is mass scale consumption of global resources like food, water, minerals etc. This, also, has increased waste and hazards. The costs of cleaning such waste and hazards are so great that society is beginning to realize the impact. It has become so important that the stakeholders, that is, businesses, society and political leaders are now talking of a greener and safer environment. Organisations like Environmental Protection Agency and Greenpeace seek to reduce greenhouse gas emissions believing to be causing global warming. Thus, huge sums of money are being spent by businesses and the government in order to protect the environment.

I will be establishing the cost benefits to Irish farmers of reducing the pollutants and cleaning up contaminations in soil and water which greatly has adverse effects on the environment. I will be exploring some literatures in this topic area which may guide me in going about my research topic.

1.3 Justification for research

Everyone is talking about climate change and / or global warming. Some are doing their bit to reduce the effect while others think that it is not happening and if it is, it is the problem of others. Reducing the effect of environmental hazards which contribute to climate change is very costly and I intend to find out how Irish farmers are dealing with these costs and to analyze the cost benefit of adopting more environmental practices.

Climate Change: How do we know?

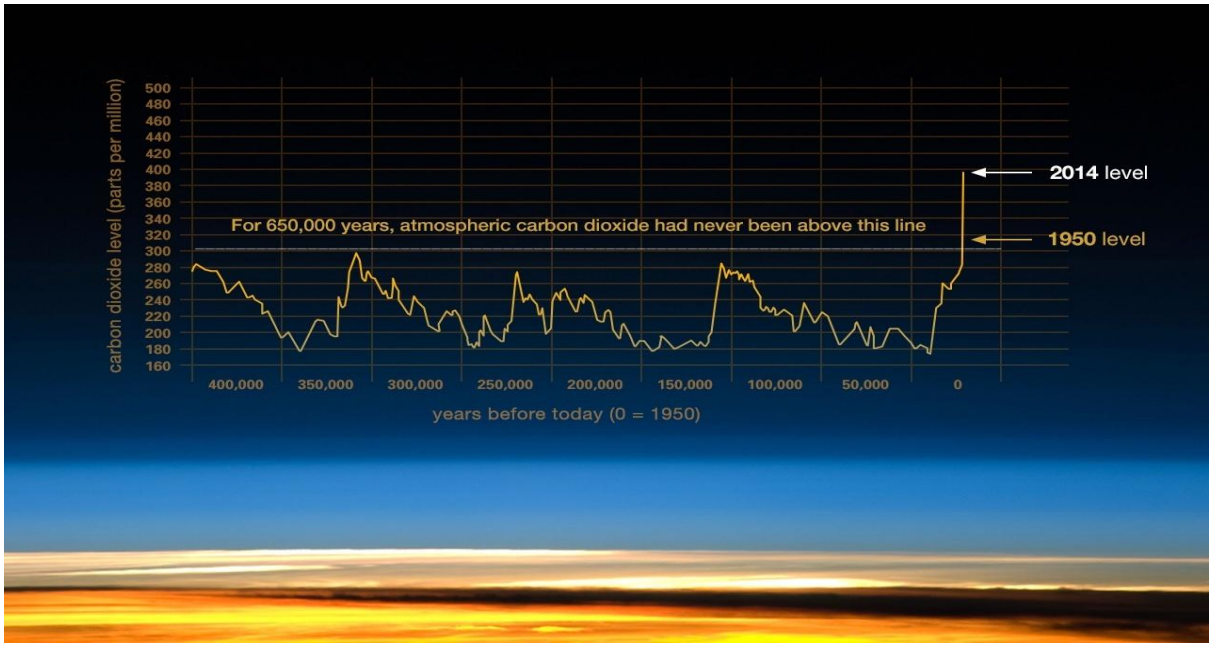

Figure 2: Source : NASA (NASA, 2015)

Due to my love for agriculture, the fact that agriculture contributes immensely to the Gross Domestic Products (GDP) of most economies, a source of employment for many and a channel for life, I want to bring to light the costs benefit effects to farmers (especially Irish farmers) of adopting more environmental practices to address environmental issues. I also want to identify the help which the Irish government is giving to farmers on addressing environmental issues and to examine the extent to which such help is accessible by farmers.

1.4 Business discipline and academic areas related to the research

Environmental related studies do cut across so many disciplines and academic areas. It is a scientific as well as business like study. Each activity carried out by the human race does affect the environment in one way or another. However, for the purpose of this research and my area of studies, my main focus will be on cost benefits. Thus *Accounting and Finance* relate to the research topic. Government policies and the challenges which Irish farmers are facing in addressing environmental issues are also of vital concern. Hence *Environmental Management* also relate to the topic area. In other to reduce the effects of environmental issues, Irish farmers may have to switch to

environmental friendly products. Therefore *Business* and *Marketing* relate to the research topic.

1.5 Structure of the study

In order to fit this work into the researches already carried out on the environment and agriculture, the work is broken down into a number of sections and sub-headings that provides consistency and coherency to the users.

In chapter one, the reader will have a broad knowledge and a snapshot of the problem that is being investigated, the aims of the research and where the research fits into the wider context.

Chapter two reviews the work of related researches already carried out and enables me to draw themes and concepts as I progress with this research. The chapter is further broken down into the following sub-headings for a better understanding of the objectives of the research:

- Meaning and causes of environmental issues
- Meaning of cost benefits analysis
- Measuring and pricing climate change
- Costs benefits analysis on farms
- Ireland and EU context
- International context
- Conceptual framework

The conceptual framework lays out the different themes found in the literature review.

In chapter three, the approach used in carrying out the research is explained. It looks at the philosophy adopted and explains the process through which primary data was collected. Access and ethical issues, nature of data, techniques of analyzing the data and potential outcome of the research were all looked at in this chapter.

In chapter four, the primary data gathered from the interviews, case study and questionnaires were analyzed. The chapter is divided into two sections – Overview and analysis section and the evaluation and discussion section. The layout of this chapter is consistent with the structure and themes gotten from the literature review.

The final chapter of this dissertation provides a summary of the findings and their implications as well as the contributions and limitations of the work. Recommendations for future research were also made in this chapter.

1.6 Conclusion

The aim of the forgone chapter was to give the consumer of this piece of work the overview and the researcher's intention of what to expect in the subsequent chapters of this dissertation. The next chapter will provide a review of work carried out by other authors on topics that are related to the topic that is being researched by this researcher.

2.0 Literature Review on Addressing Environmental Issues

2.1 Introduction:

In this section, I have reviewed various articles, journals, books and online resources relating to environmental issues. Environmental related issues have been widely investigated by many authors. Some authors have done a case study on this discipline while others have looked at various aspects such as the meaning and causes of Environmental Issues, global climate governance, green consumption, responding to climate change, soil erosion and conservation and many more. However, mindful of what studies have already been undertaken, Environmental related studies tend to be subjective as many do not believe in climate change despite the vast evidences that exist.

2.2 The meaning and Causes of Environmental Issues:

'Environment is the circumstances, objects or conditions by which one is surrounded' (Fayesoni, 2013). Therefore Environmental Issues can be defined as the destruction of the environment by human activities.

The causes of environmental issues are many and varied. Variables like the society, over population, and many more cause environmental issues. However the main cause is pollution. The pollution of air, water and land could drastically affect food supply and other basic necessities. With better development of the industrialized nations come increase in pollution causing global warming and more consumption of the world's limited resources.

2.3 Meaning of Cost Benefit Analysis:

This is a process of identifying costs and benefits of a decision or project over a certain period and those of its alternatives, within the same period, in order to have a single scale of comparison for unbiased evaluation (BusinessDictionary.com, 2014). It is a process whereby the benefits of a project are summed up and the related costs for the project subtracted.

A study that looks at energy efficiency in buildings reveals that businesses and industries often miscalculate the costs and benefits of going green. Only one out of seven respondents from the industry takes part in green building programs. It emphasizes that the true cost difference of constructing sustainable buildings is only 5%, which is three times lesser than the estimated additional cost of 17%. The authors also concluded that the greenhouse gas emissions by conventional buildings are 40% which is far higher than the 19% emissions by sustainable buildings(World Business Council for Sustainable Development, 2008)..

2.4 Measuring and Pricing Climate Change:

Despite the many incidences such as the hurricanes, rising temperatures and other adverse conditions witnessed since the 1960s, scientists or experts in the field have not been able to come up with a single instrument to measure climate change. Arrays of devices are being used daily to measure climate change. The reason might be due to the complex nature of the climate system which consists of the atmosphere, land surface, snow, ice, ocean, bodies of waters and all living things. So many variables are being used to aid in the measuring of climate change. Variables such as the observation and models of the global cooling and drying of the atmosphere, temperature, precipitation, biomass, sea level, solar activity, chemical and volcanic eruptions are extremely useful in measuring climate change (IPCC Fourth Report, 2010). Whatever the means used, the end result is to get the quantity of the methane and greenhouse gas emitted into the atmosphere for proper accountability.

Most climate scientists tend to put a price on climate change by pricing the amount of Carbon Dioxide (CO2) gas emission through the use of mean global temperature which is widely used in climate science. The reason for the reliance on this method is due to the fact that there is a positive correlation between mean global temperature and carbon concentration. Climate change integrated models show that there will be a big negative impact on climate if there is an increase in the carbon concentration in the atmosphere. Thus based on certain assumptions such as the relationship between carbon emission and carbon concentration, mean global temperature and carbon concentration and many

more, estimate of the shadow price of carbon concentration lie between a loss of $5 a ton of carbon and $100 or more per ton. Therefore the global shadow price of carbon is the estimate of the algebraic sum of the regional shadow prices. Hence, an increase in the stock of carbon concentration in the atmosphere will reduce future consumption (Dasgupta, 2014).

2.5 Cost Benefits Analysis on Farms

Many literatures were reviewed but none was on the cost benefits of adopting environmental practices. However, in the study 'A Cost Benefit Analysis of Wind Power', the author Eleanor Denny asserted that to investigate the cost benefits of wind generation, the power system within which the wind is installed has to be analyzed in terms of the costs and the benefits. Thus the costs, which can be increased, include the cost of capital and the cost of operating the wind generation, the costs of network reinforcement, the costs for additional reserve and the costs associated with additional cycling of conventional units. On the other hand, the benefits derived include the capacity benefit of wind, the savings in emissions and fuel costs savings. The author also concluded that based on certain variables, increased interconnection, high Carbon Dioxide (CO2) prices and a flexible plant mix are beneficial for generating wind with a positive net benefits for wind energy penetration of at least 17% (Eleanor Denny, 2007)

In a study that looks at 'a cost benefit analysis of farmers based seed production for common bean in Kenya', the authors affirmed that the farmer based seed production was more profitable and less sensitive to price fluctuations. However, the net profit margins were five times more for the certified common bean seed production than for the farmer based common bean seed production. It should be noted that profitability depends on variables like good agronomy and access to irrigation. The authors also asserted that with the introduction of seed varieties that adapt to environmental stresses like drought tends to enhance profitability(E. KATUNGI et al., 2011).

To ascertain the cost benefit analysis of environmental management, the physical information about the impacts of the environment is an essential prerequisite. To effectively carry out a cost benefit analysis, the following steps could be used as

guidelines: defining the projects; identifying relevant economic impacts; physically quantifying the impacts; a monetary valuation calculated; discounting; weighting and then perform a sensitivity analysis (Nick Hanley and Clive L. Spash, 1993)

2.6 Ireland and EU Context

According to the Environmental Protection Agency, the Irish greenhouse gas emission in 2011 was about 4% above the 1990 levels. This implies that Ireland is on target to meet its Kyoto Protocol agreement of keeping emission to less than 13% based on the 1990 figures. Comparing this 2011 figures with other EU countries, Ireland's emission profile is very unique because emissions from agriculture amounts to about 32% of the total emission (Gemma O'Reilly et al., 2012). However, this good news did not last for long because until very recently (Nov. 2014), the European Environmental Agency revealed that Ireland is set to fail its binding 2020 target of greenhouse emission gas. Currently, the greenhouse gas emission for Ireland stands at 20% below 2005 emission levels, making the Irish target to be the highest in the EU. Agriculture and transport make up 70% of all emissions. There are no clear and meaningful strategic efforts to reduce emissions and there is complete failure by the government to enact climate change law. Instead of coming up with policies to reduce greenhouse gas emissions, the government's economic recovery plans emissions from agriculture will rise under the Food Harvest 2020 expansion program(Wordpress, 2014).

Agriculture is one of the most sensitive sectors because it depends hugely on temperature levels and rainfall. According to Dr Stephen Flood at NUI Maynooth, the sector will face losses of up to *two billion euro* yearly if climate change is not checked. This may have a huge economic impacts over the next 40 years should the climate change be allowed to continue unchecked(Ciara Kirrane, 2013). This view was echoed by the Minister for Agriculture, Food and Marine, Simon Coveney TD when he says:

"In continuously developing the agriculture sector, I am conscious of the need to take into account the projected impacts associated with future climate change. There is a large amount of work underway within my Department on climate change mitigation measures. In addressing climate change, it is essential that everyone plays their part and, in this regard, I am delighted to see key representatives of both the farming and

environmental sectors here today, intent on finding ways to work together to ensure the ongoing success of Irish agriculture."

It is generally believed that the soil in Ireland is of good quality and relatively rich in soil organic matter. With around 70% of Irish land under permanent pasture, the risk of depletion in soil organic matter is less. Even though soil erosion is rare in Ireland, instances of overgrazing, poor soil management practices on vulnerable soils including inappropriate cropping regimes, and direct access for grazing livestock to watercourses have been reported as causes of soil erosion in areas where they exists. Soil compaction, contamination and loss of organic matter were also reported as the main threat to Irish soil. Increased overland flow of nutrients and reduced agricultural production are potential risks that could be suffered in the long run by certain areas that experience the use of heavy agricultural construction machinery and high stocking rates at inappropriate times. There are strict EU and Irish soil conservation policies in place (Department of Agriculture, 2009).

In the face of increased population and the increasing demand for agricultural products in our world today, Ireland is not alone in the search for ways to preserve the soil. An article by Fullen (2003) that looks at soil erosion and conservation in Northern Europe indicates that soil conservation policies are suggested at national, regional and local levels. In Denmark, for example, there is an integrated approach to soil management, including afforestation, the use of set-aside, uncultivated 2-m-wide strips in riparian zones, and extending of permanent grassland. In Germany, on March 1 1999, The Federal Soil Protection Act (Act on Protection against Harmful Changes to Soil and on Rehabilitation of Contaminated Sites) became Federal Law. The aims of the Act were to 'protect and restore the functions of soil on a permanent and sustainable basis and concentrate on both precautions and hazard protection.' The author suggests that there should be a 'cost share' partnership between the government and farmers in funding conservation work on farms and most importantly, education programs to actively inform the public on the importance of soil as an important resource is essential (Fullen, 2003).

In her article, 'Environmental Rights for the Future? Intergenerational Equity in the EU', Linda Collins asserts that the principle of sustainable development has been well embraced in Europe more than any other region; but Europe still suffers huge

environmental degradation. Despite Europe's commitment to respect the ability of the future generations to meet their needs, Europe has failed to implement meaningful safeguards to future human beings for their environmental rights (Collins, 2007).

2.7 International Context

According to the reports from The Intergovernmental Panel on Climate Change (IPCC), the effects of climate change is now being felt across the oceans and all continents and in many cases, the world is not yet prepared to tackle the challenges from the changing climate. Even though there are opportunities to respond to these challenges, they are however difficult to manage. Thus, responding to the challenges of climate change, which in most cases are man-made, means making choices about risks in a changing world. Therefore making the right investments now to better prepare could pay good dividends now and in the future(Nino Florencia Soto, 2014).

Sarkar (2011) asserted that the challenges of climate change is unique and to address the problems of climate change every hand has to be on deck to look for sustainable solution. Various institutions like UNFCCC, IPCC, COPS and others, have only offered partial solution to the problem. Thus the debate of reducing greenhouse gas emission by the developed and developing countries have remained opened-ended due to lack of firm commitments from the major polluters. There are no clear-cut policies among or between stakeholders on the modalities of burden sharing in funding the mitigation (Sarkar, 2011).

According to Connolly and Prothero (2008), individuals should be responsible and empowered in dealing with the risks of the environment globally and to themselves based on what they consume. The researchers stated that the notion of green consumption makes people feel, think and act in a particular individualized way thereby making them believe that, as individuals, they can help address environmental issues (Connolly and Prothero, 2008).

Learning and awareness of ways to addressing environmental issues has to be simple and easy to understand. According to Vandenabeele and Wildemeersch (2012), learning is the core to sustainability projects because sustainability is very challenging and

requires creative solutions. They asserted that the confrontation with the strangeness of others with different ideas of protecting the natural environment enhances a strong dynamic of apprehensions which are coping with fear and learning. Therefore, Environmental learning is a process in which people are prepared to cope on with the views of others and thus face the ambivalences as a consequence (Vandenabeele and Wildemeersch, 2012).

In an article that looks at Knowledge Exchange in Sustainable Agriculture, the authors use conceptual frameworks drawn from contributions to social movement theory to show that grazers can overcome the limit of their personal experience through horizontal form of organization and information exchange in local social networks. They emphasize that knowledge exchange through local networks is a way of practicing sustainable agriculture (Hassanein and Kloppenburg Jr., 1995).

Just and Antle (1990) develop a conceptual framework used to analyze the interactions between agricultural and environmental policies and pollution. According to the authors, agricultural and environmental policies can be categorized based on their effects on the intensive and extensive margins. Both agricultural production and environmental impacts highly depend on the location of specific environmental conditions (Just and Antle, 1990)

In their theory of reflexive modernization, the authors (Stuart et al., 2012) explore the importance of social constructionist and political perspectives. The authors asserted that perception of risk are varied and complex. Thus some farmers perceived climate change as a risk while others do not. Farmers who did not see the link between agriculture and climate change also did not see the boomerang effects which connects specific actions with negative impacts. Many farmers do not believe that climate change is a real treat. However, those who do believe, measure climate risks with other risks as well as other economic stability in a political economy that prioritizes production.

In an article which looks at the competencies demonstrated by farmers while adapting to climate change in Canada, the authors cite planting forage radish and practicing more crop rotations as competencies necessary for farmers to make their soil more resilient to climate change. They also mentioned the possession of in-depth local and agricultural knowledge, critical thinking, futures thinking and hindsight, identification and control

of the variables affecting the crops, openness to novelty, collaboration, optimism and self-efficacy as key attributes to be possessed by farmers as they attempt to address the impact on climate change on their crops (Pruneau et al., 2012).

According to Naylor (2006), Environmental Safeguards for Open-ocean Aquaculture should be put in place in the US. They suggest that unless the aquaculture industry shifts to a sustainable path, the same environmental damages caused by intensive crop and livestock farming could be repeated in fish farming (Naylor, 2006)

2.8 Agricultural Practices in Ireland

Agriculture could be defined as the keeping, breeding and sale of livestock; the making and storage of silage; the cultivation of land and the growing of crops. Since 2010, agricultural practices in Ireland are being regulated by the statutory instrument No. 610 – Good Agricultural Practice for the protections of Waters (GAP) Regulations. This regulation covers the rules on slurry storage capacity, application of organic and inorganic fertilizers, livestock stocking densities and farm facilities(THE STATIONERY OFFICE, 2014).

According to a survey carried out by Teagasc, it is clear that the following agricultural practices are performed in Ireland (Thia Hennessy et al., 2011):

- The use of slurry and / or farmyard manure
- The use of organic manure by ploughing
- Tilling of land

Slurry is the excreta of livestock produced while in a yard mixed with rainwater, washings and other extraneous materials. Farmyard manure is the mixture of bedding material and animal excreta in solid form from housing of cattle, sheep and other livestock except poultry.

This survey by Teagasc found that large quantities of these materials – slurry and /or farmyard manure are being used by farmers. The tilling and ploughing of land also

involves the use of large machineries and large consumption of fuel. It implies, therefore, that large amount of carbon dioxide are being emitted into the atmosphere by Irish farmers when carrying out these agricultural practices.

2.9 Conceptual Framework

Even though there are numerous researches already carried out on Agricultural issues relating to the Environment, this research is principally on the cost benefits element on adopting more environmental practices by Irish Farmers. Various themes were identified throughout the literature reviewed and these themes formed the pillar on which the research objectives were achieved. Thus, these themes acted as guide on how the interviews and the case studies were carried out:

Government policies on Climate Change / Extent of communication of such policies	**Farmers' Education on Climate Change / Willingness to learn**	**Agricultural practices**	**Measuring Carbon dioxide gas emission**	**Cost of not going green vs cost of going green**
Responsibility for informing farmers of policies / Policies Implementation and Support	Farmers' Attitude / Approach to Climate Change	Use of green technology / Change of Culture	Do farmers know how to measure their CO2 / Do they really care	Cost benefits of going green
Irish Climatic condition in relation to GHG emission	How Farmers contribute to GHG emission / Are they aware of this	Policy strategy for reducing the GHG emission	Current cost per ton of CO2 gas emission	Maintaining commitment to reduce GHG emission / Establishing knowledge exchange program between farmers

Table 1: Conceptual Framework

In order to achieve the desired effects to climate change from the agricultural sector, it is vital that good and sustainable policies are in place and farmers be educated on how to adopt more environmental tools and practices.

2.10 Conclusion

The current climate change pattern is of huge significance to the world mostly because of induced human activities. The ozone layer is depleting at alarming rates and if nothing is done to remedy the situation, earth's living things would all be under immense threat and chaos. From the literature reviewed, it is clear that the solution to Climate Change is the responsibility of all. Government policies, Education and Change of mentality are some of the ingredients needed to remedy the effects of climate change.

Although much have been said on agriculture and climate change, the research is on the cost benefits of adopting more environmental practices by Irish farmers; no literature was found which was directly linked to the research topic. Hence, this research sought to fill this gap. Thus the next chapter will be on the methodology, techniques of data collection and sources of data.

3.0 Research Design and Methodology

3.1 Introduction

This chapter outlines the research approach and methodology used to provide answers to the research questions. In trying to come up with the methodology for this research, emphasis was placed on the approach realized in the literature review as well as my own philosophy on the subject matter.

The strategy, process and method used to collect and analyze primary data will also be discussed. It was the intention of the researcher to carry out two case studies for the purpose of this research as well as conduct some interviews from experts in the field. However, due to time constraint, only one case study was carried out, five interviews conducted and 55 questionnaires received out of the one hundred that were sent out.

3.2 Research Paradigm

The research philosophy on cost benefit analyzed is both qualitative and quantitative. It is qualitative because aspects of the research dealt with the perceptions of the target audience which is subjective. On the other hand, it is quantitative because hard facts and statistics on the costs incurred by the target audience were analyzed and material facts gotten which helped buttress the perception and experience of the target audience. Thus Costs Benefits analysis is both objective and subjective; and it therefore required the researcher to use methods that summed up their language and behaviour. Thus the interpretivist and the positivist approaches were used to carry out this research.

A research paradigm can be defined as a method of investigating social phenomena from which particular understandings of these phenomena can be gained and explanations attempted(Saunders et al., 2007, p. 112). It is a framework of all the accepted views on a subject matter and the procedure on performing the research. The interpretivist and positivist approaches are in line with my reason and believes of my topic choice as well as the knowledge gained from the literature reviewed which is that the whole notion of climate change is subjective and objective to an extent. The

interpretivist approach reflects the facts that humans would always try to make sense of what is happening around them and by so doing, they would have different opinions on the same issue. The positivist approach is based on the fact that costs are being incurred while performing the agricultural activities. These costs statistics are useful tools to better understand the perceptions of the target audience. These are no different with my research topic of *cost benefits analysis* on which conclusion was drawn based on the subjective words of experts, the data that was collected and the case study that was carried out.

The main justification of choosing the interpretivist approach is my believe that if climate change and other environmental issues are to be brought under control, society must first of all believe that climate change and/or such environmental issues is happening and then try to change their attitude in the way things are being done in order to reduce the GHG emission into the atmosphere. This whole concept of climate change is subjective, deals mostly with the activities of humans and thus difficult to analyze. My research topic (Insight into the issues and challenges of adopting more environmental practices by Irish Farmers) deals with social phenomenon which is subjective and thus certain understandings have to be drawn from it to arrive at a more sensible conclusion of what may be useful around the globe in trying to solve the problem of climate change.

In order to assist the readers of the research, the researcher tries to embed the topic into the various research concepts:

The ontological concept concerns with the nature of reality. It is a concept of social phenomena and how it can be admitted into a knowledge system (Saunders et al., 2007, p. 108). Therefore, from an interpretivist perspective, the notion of *reality* is subjective which may represents the attitude of Irish Farmers in adopting more environmental practices to addressing environmental issues. This subjective reality can be buttressed through a quantitative approach of collecting data on the costs incurred by farmers and the statistics analyzed to get the cost benefits effects. The main objective of the research is to establish the cost benefit effect to farmers on adopting environmental practices. Before this research was carried out, it was my assumption that farmers may have different beliefs on the notion of climate change and a change of culture, education and

policies may be difficult to implement completely in order to reduce the GHG emission into the atmosphere.

The Epistemological concept concerns with the nature of knowledge. It concerns with what constitutes a valid knowledge in the field of study and asked ‘what is the relationship of the researcher and that being researched (Collis and Hussey, 2003 p.49)? Both the researcher and that being researched are both humans with subjective thinking. This places the researcher in a position of wanting to know more and analyze the cost benefits effect of that being researched. In trying to do this, the researcher is closing the gap with the missing knowledge that was not yet available before this study.

The Axiological concept deals with value. The research main objective is to analyze the costs benefit of adopting more environmental practices by Irish Farmers. This will be value laden since no published research on this study area is available. The researcher intends to show, analyze and also educate Irish farmers on the costs benefit of adopting environmental practices. The value of the researcher will be priceless.

The approach used in conducting this research is the inductive approach which seeks to establishing a theory on the costs benefits effect for adopting more environmental practices. This approach has been chosen because the topic under research tends to be more subjective than objective and it is more in line with the interpretivist paradigm. To better understand and draw a credible conclusion, experts in the field were interviewed, case study on a tillage farm carried out by the researcher and data on the costs incurred by farmers for adopting non environmental practices collected and analyzed. Thus, the inductive approach allows the researcher the freedom of bringing together all the meanings from the different respondents for a single theoretical conclusion.

3.3 Research Strategy

To get a better analysis of the concept, the qualitative as well as the quantitative research methods were used. These methods consist of conducting interviews as a means of collecting the primary data, collecting data on costs for adopting non environmental practices as well as the case study carried out. Five interviews were conducted, one case study carried out and fifty-five responses gotten from the questionnaire.

3.4 Methods for collecting and sources of data

Both primary and secondary data were used for data collection. Primary data was gotten principally from interviews from experts in the field, questionnaire and from the case study. Five interviews were conducted, 55 responses gotten from questionnaires and a case study on a tillage farm done. The case study was the corner stone upon which the research was developed. However the in depth one to one interview with experts in the field and the questionnaires were supplementary to the research.

Secondary data came from the related industry, the literature reviewed and/or archives. The importance of the use of secondary data in the research could not be overemphasized as the researcher did not have the resources to conduct or carry out certain primary data.

Therefore my sources of data were from the experts, archives, literature review, questionnaires and the case study.

3.5 Access and Ethical Issue

In accessing my sources, I sent them a one pager requesting their assistance for the research. A friend linked me up with his friend who is a farmer. I got some assistance and access to some fruitful information from officials in Teagasc.

Ethics, ethics and ethics were followed and will remain my watch phrase as confidentiality is paramount. I will not hesitate to give or state my commitment to privacy and anonymity if need be. No materials collected have been twisted to suit my ideas. All the data collected have been used solely for the purpose of this research.

3.6 Nature of data

As earlier mentioned, the methods used for this research were both the quantitative and the qualitative methods. Much attention was paid to the qualitative method of the research even though it is outside the positivistic sphere. This is buttressed by the fact that data for this research was mainly subjective since it entails interviews and case studies. The quantitative bid was from the questionnaires. The types of questions asked

were descriptive in nature and covered the areas already stated in the conceptual framework above (see Table 1).

3.7 Possible techniques for data analysis / interpretation

In line with the method of research chosen, which is qualitative, and the quality of interviews that were carried out, data has been analyzed and interpreted based on my research objectives and the various themes in my conceptual framework. The use of coding will also be of major importance for analyzing the data since it allows for systematic analysis of huge amount of data. Every theme will be analyzed in turn as per the case studies and the feedback from the interviews.

Also, attitudes and body languages of the respondents were paramount because some inferences were drawn from interviewees using these variables.

3.8 Potential Outcomes of Research

This research was carried out to analyze and proof to farmers that there are cost benefits to adopt more environmental practices. It is a fact that in Ireland for example, farmers are the second emitters of GHG emission into the atmosphere after the motorists. This, as it is widely known, is causing enormous damage to the ozone layer and having huge implications on the environment. It is the believe of the researcher that the potential outcome of this research is to create awareness and add to the already existing literature on the cost benefits of going green.

It is also the hope of the researcher that this research will close the gaps that exist within the literature in this topic area. The research will bring to light the missing ingredients and add more knowledge to the already existing literature.

3.9 Conclusion

The aim of this study was to have an insight into the issues and challenges faced by farmers in adopting more environmental practices as well as to ascertain the cost benefits of adopting such practices. This will be an addition to the already existing literature on environmental practices. The methodology chapter also set out the philosophy applied in the study and the techniques of data collection in order to find out the missing jigsaws to the research puzzle. Data analysis approach discussed in this chapter was the guiding tool for the next chapter on presentation and analysis of findings.

4.0 Presentation and Discussion of the Research Findings on the 'Issues and Challenges of adopting more Environmental Practices by Irish Farmers

4.1 Introduction

The research was done as outlined in the previous chapter – Research Design and Methodology. Data collected will be analyzed to reflect the various theme as arrived at in the literature review chapter of this work - Government policies on Climate Change / Extent of communication of such policies, Farmers' Education on Climate Change / Willingness to learn, Agricultural practices, Measuring Carbon dioxide gas emission and Cost of not going green vs cost of going green.

Data collected from the case study, interviews and questionnaire is hugely subjective as this represents the feelings and opinions of the parties involved. Due to time constraint, a detailed analysis that would have been quantitative in nature was not possible.

4.2 Data Analysis

Five interviews were conducted with experts from agricultural and environmental backgrounds in other to get the different debate pertaining agricultural practices on one hand and the environment on the other. Interview request was sent out to 10 experts – 7 males and 3 females. However, 5 out of the 10 (i.e. 50%) accepted the researcher's request. The interviewees were two farmers, two educators and one environmentalist. All of the interviewees were male. This gender imbalance reflects the gender inequality in agriculture.

A case study was done in a tillage farm which gave the researcher the opportunity to learn the different processes that are involved from when the crop is sowed until when it is harvested and ready to be sold. It also gave the researcher the opportunity to see first-hand some of those activities which contribute negatively to the environment. It should

be noted that the researcher has no farming background and neither is he an environmentalist.

Survey questionnaires were handed out to 100 farmers around the country. Out of these, 55 responded to the questionnaires which represent 55% of the target audience. Of the 55 who responded, 11 (20%) were females and 44 (80%) were males. Another interesting factor that was noticed was the age profile of the respondents. Of the 55 respondents, 29.09% were 39 years of age or younger while a massive 70.9% were 40+ years of age. Thus the age profile has a correlation with farmers adopting more environmental practices.

4.2.1 Understanding the Meaning and Awareness of Climate Change

Agriculture is contributing immensely in bringing the country out of its current economic down turn. According to the Central Statistics Office (CSO), the value added of agriculture increased by 10% in terms of volume in 2014 i.e. from €4,008 million in 2013 to €4,410 million in 2014 (Central Statistics Office, 2015). As one interviewee puts it '*we can produce milk and beef cost effectively because grass is cheap to grow in Ireland, making Ireland to have a competitive advantage and thus a better chance of bringing the country forward'*. Despite the economic benefits brought by this increase, it also brought a negative effect by increasing the CO2 emission into the atmosphere through the activities of the farmers. Farmers have to get the balance right, making sure, for example, that the correct amount of nitrate is used and not to damage the water quality. The question that comes to mind is whether or not farmers know what climate change is all about or are they aware that their activities do contribute hugely to climate change. To get an understanding of what is going on, the researcher started part two of the questionnaire by asking farmers: Do you understand the meaning *of climate change?* The questionnaire respondents were given a choice of three possible answers to choose from - □Yes, □No, and □Not sure. 50% said they understood the meaning of climate change, 10 % did not know the meaning of the term and a whopping 40% of the respondents were not sure of their understanding of climate change.

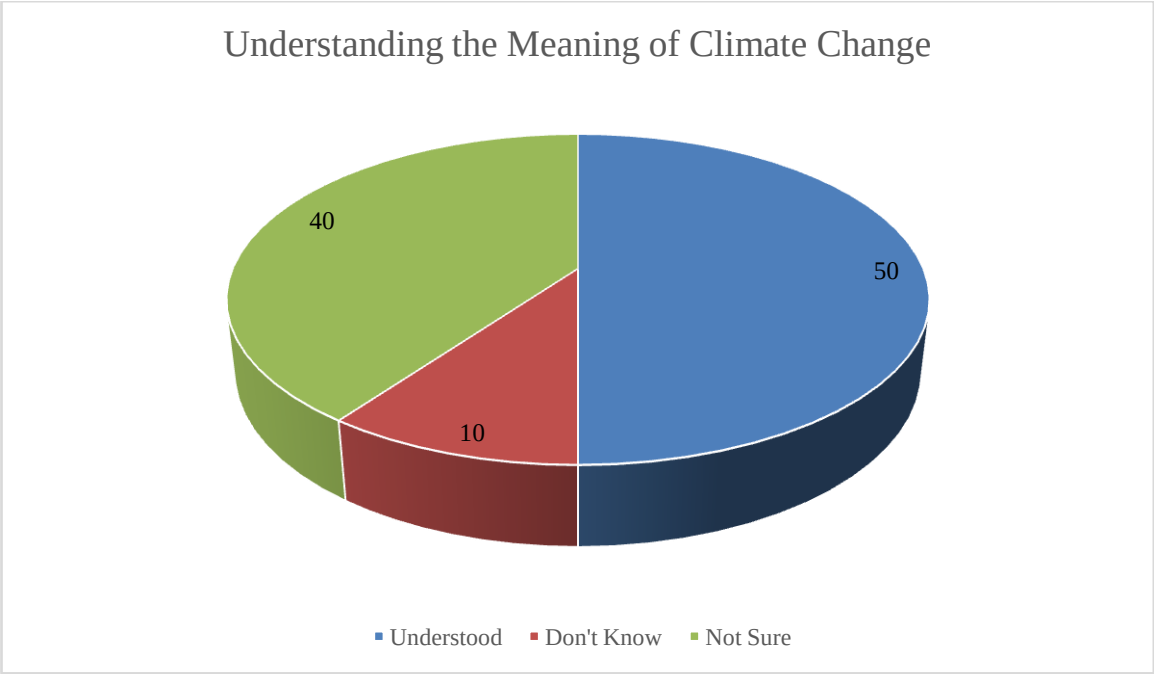

Figure 3: Understanding the meaning of climate change

It was interesting to note that 70% of the questionnaire respondents believed in climate change. They have heard about it from the media and other sources. However some farmers are not aware or well informed how this could affect them directly, apportioning blames to left, right and centre.

Despite the believe of climate change by the vast majority of farmers, raising awareness of Green House Gas (GHG) emission and bringing the farmers along by the authorities to adopt more environmental practices remain a challenge. To test my assertion, farmers were asked in the questionnaire: Are you aware *of government policies on climate change?* The response gotten from respondents show that there is still a steep mountain to climb by the government if the government is to meet its 2020 GHG gas emission target of 20%. A vast number are not aware about government policies on climate change, let alone implementing it. 36.4% of the respondents said that they are aware of government policies on climate change and 36.4% also said that they are not aware of such policies.

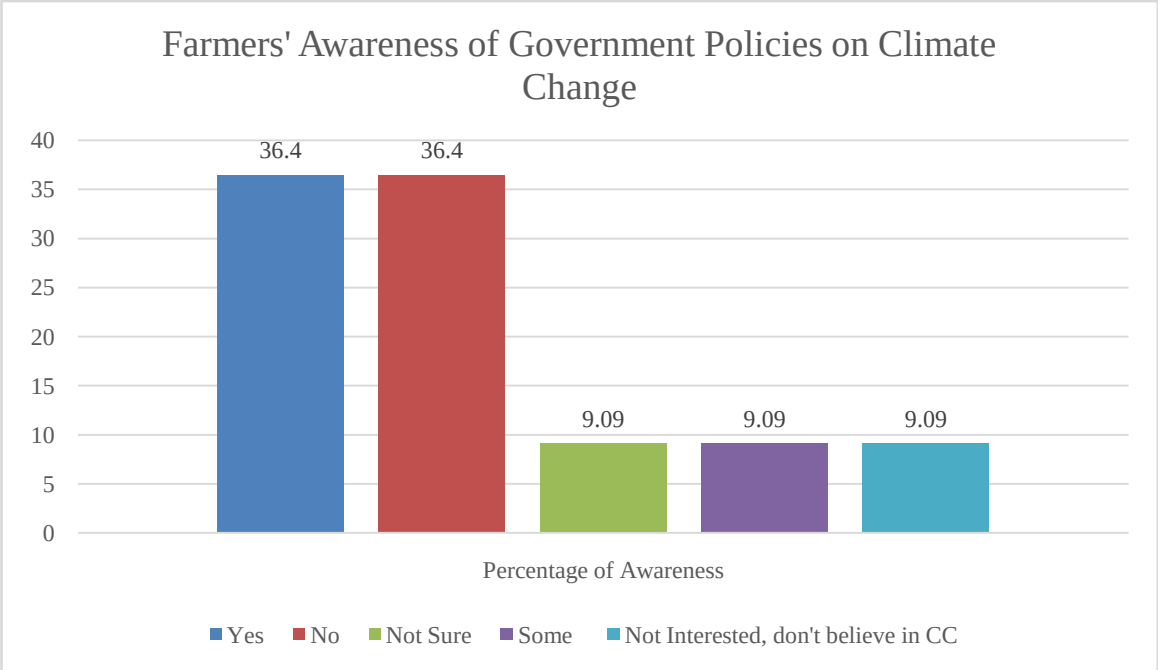

Figure 4: Farmer's Awareness of Government Policies on Climate Change

Because a vast majority of farmers are not aware of government policies, so implementation rate is almost the same to the non-implementation rate. Only 50% respondents confirmed that they do implement government policies of climate change as compared to 40% who said they are not implementing the policies. It suffices to believe that such high rate of non-implementation is as a result of poor communication of such policies to farmers. This is buttressed by the fact that a question on the questionnaire asked farmers: *are climate change policies well communicated to you?* A resounding 50% of the respondents said 'no' as compared to only 30% who said 'yes'. This question was put to an interviewee who is an expert and educator in the field and he said *'Farmers do have lots of educational programs and representatives all over the country; for example, there are representatives on the Environmental Protection Scheme for the last fifteen years, there is the new Green, Low-Carbon, Agri-Environmental Scheme (GLAS) which promotes agricultural actions best suitable for the environment. Some of the problems rest with the older generation who are conservatives and are not helping matters by not investing in new environmental friendly technology. Thus there might be resistance to change from older farmers than from younger famers'.*

Despite the differences and the conflicting responses in the meaning and awareness of climate change from farmers, education is the key to bring farmers into the debate in order to collectively fight the common enemy, climate change. It is time to educate farmers on the consequences of climate change and ask them to bring up ideas on how to go about solving the problem rather than telling them what to do.

4.2.2 Farming Culture and contribution to GHG Emission and Policy Strategy for Reducing GHG Emission

Most farmers are aware that their activities on their farm do contribute to the depletion of the ozone layer which causes climate change. To find out if farmers know that some of their actions have negative effects to the environment, I asked them: It is on record that farmers in this country are the second polluters of the environment after the motorists. Are you aware that your farming practices contribute negatively to GHG emission? A resounding 70% of the respondents said 'yes' as compared to the 20% who said 'no' and the 10% who said 'somewhat'. Activities such as slurry spread close to a river, animal waste recycling, silage and liquid milk effluent, diseases from livestock, excess use of nitrogen etc. are some of the farming activities that emit greenhouse gases. Another environmental hazard caused by farmers could be through water pollution in the form of Phosphate, Potassium or Nitrogen which comes from waste that animals produced or the fertilizers that farmers put onto the land. An interviewee was asked: *what are the activities carried out by farmers that pollute the environment*? The reply was '*It depends on the matrix or measures one is using. Agriculture produces a lot of greenhouse gas which is partly as a result of the type of animals' ruminants in the country; that the sector is disproportionately disadvantaged because they do not allow forestry to offset against it as a carbon sink'.* The challenges are immense, especially with the older generation of farmers who could be more difficult to change their farm practices or even partake in a knowledge exchange program. Looking further into this exchange program, I asked the respondents if they would be happy and willing to participate in a knowledge exchange program on climate change and good farm practices between farmers. The reply was hugely negative with 70 % saying either 'no' or 'not sure' while only 30% will be willing to engage in such program.

The good news, as per the survey, is that farmers are also concerned about the depletion of the ozone layer. I asked the respondents – would you be concerned that the emission from your farming activities is depleting the ozone layer and causing climate change? 80% said 'yes' as compared to the 20% who said 'no'. As a follow on to the previous question, I asked if farmers would be prepared to adopt more environmental practices (e.g. green technology, etc.) on their farms. Again an overwhelming 70% of the respondents said 'yes, if given the support' while 20% said 'yes, regardless of any support' and 10% said 'no'. This is an indication that with the right attitudes, both the government and the farmers could work together and easily overcomes the challenges posed by climate change.

Farmers do not want to pollute the environment deliberately. Some do, some don't. But the vast majority of farmers do the right thing. However, getting farmers to adopt more environmental practices could be a hard nut to crack because some of them do not understand the concept of greenhouse gas emission. In the questionnaire survey, a question was asked: *Do you know or understand the concept of greenhouse gas emission?* 30% of the respondents testified that they don't know the meaning of GHG emission, whereas 30% said they are not sure and only 40% knew the meaning of the term.

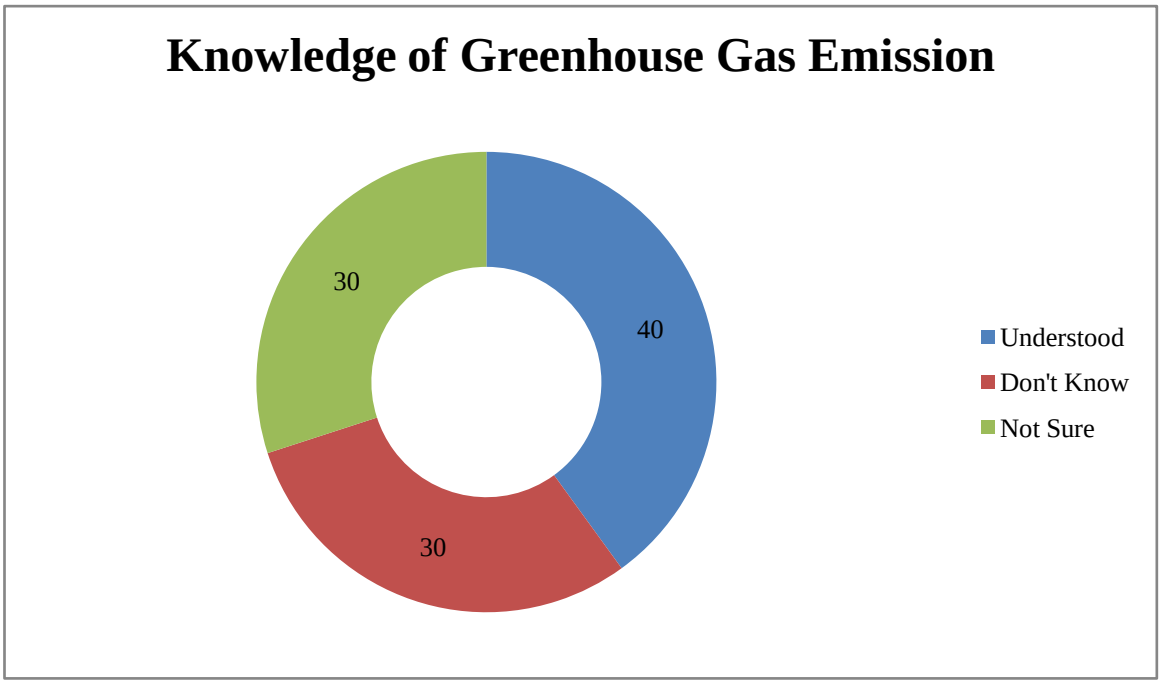

Figure 5: Knowledge of Greenhouse Gas Emission

The government policy for reducing climate change is based on strict control on the activities carried out by farmers on their farm. Government has a target of reducing emission by 20% by 2020. This could be easily achievable if government could win the hearts and minds of farmers, may be through supports and education. However, it would appear that the supports given to farmers are minimal as compared to what is expected in return.

It is the government policy to farmers not to use, for example, a slurry spreader spreading liquid slurry splashing upwards. It must now splash downward so as to reduce the smell and thus atomized more easily. In the past, it was splashing upwards and the smell was everywhere. To help farmers on the cost of purchasing this machine, there is grant aid for slurry equipment to make little trenches so that the slurry could be used more effectively in the soil. The raison d'être is that the less air pollution you have and the less emission you have, the more effective is its use in the soil. To affirm this, an interviewee said *'farmers tend to work on the percentage of availability. It is now 40% availability for nitrogen in the fertilizer from the slurry of animals (and the other 60% is deemed not readily available) which is used as manure for growing crops. There is the tendency of recycling in the farm and a net balance must be done'.* It should however be

noted that the law of the land stipulates how much fertilizer a farmer could buy. Farmers are confined in the spreading of fertilizers at a certain ceiling. However, if farmers can proof to the department of agriculture that the farm yields are of high quality, a small increment in the nitrogen level may be allowed by the department. My query with this policy is that if all farmers could proof this high yield theory, then they are eligible to get the green light to use more nitrogen. When all these small increments are put together, they will eventually become large. This again is a problem to the environment.

Further policy strategy for reducing emission can also be seen in the water pollution act; as stated by an interviewee: '*If a farmer is found guilty of polluting the water course, under the water pollution act, the local authority or the fishery authority could come after the farmer. Under cross reporting, one statutory body must report to the other statutory authority and instead of going to the court, the Department of Agriculture can act by cutting the grant/aid to this farmer. This helps to prevent such act from happening again'.*

4.2.3 Knowing the Carbon Footprint and Change of Mentality

As discussed in the previous section most farmers are aware that their farming activities do contribute hugely to climate change. The problem farmers faced is knowing the amount of such contribution. There is much talk about carbon footprint but knowing how to calculate an individual footprint still remains an arduous task.

Participants of this research were asked if they know how their carbon footprint is calculated or measured. A resounding 80% of the respondents either do not know or are not sure, 20% said 'somewhat' and none said 'yes'. This indicates that a lot still has to be done if the challenges of climate change have to be remedied. Ways still have to be developed where individuals can easily calculate their carbon footprint at the touch of a button.

Also, the respondents were asked if they would be prepared to reduce their carbon footprint if they are aware or know its damage to the environment. 60% of the respondents said 'yes', 30% said 'somewhat and only 10% said 'no'. This shows that

farmers are individually willing to play their part in the reduction of GHG emission if they know their output from their input.

4.2.4 The Case Study

Due to time constraint, I did a one day intensive case study in a tillage farm. It was my intension to do a case study as well in a livestock farm, but having access to same was not possible. Thus the whole purpose of clearly defining which of the two sections pollutes or emits more was partly defeated. Nonetheless, knowledge gotten from the interviews conducted will form the basis of my argument when comparing both sections.

The case study was carried out in a 250 acres farm. My intention was to see, as well as find out those activities which farmers do that emits gases or pollutes the atmosphere. I quickly realized that farming involves putting in longer hours with the use of machineries which emit large amount of Carbon dioxide (CO2) into the atmosphere and thereby causing the depletion of the ozone layer. I also realized that if proper care is not taken on the farming inputs like fertilizers, it may end up polluting the water course.

On this 250 acres tillage farm, the processes involved from planting until when the crop is harvested and which takes considerable machine hours as well as human hours are:

- Ploughing
- Sowing
- Spraying
- Fertilizer spreading
- Harvesting
- Miscellaneous (e.g. straw collection)

To plough the 250 acres of farm land, the farmer uses the following number of hours:

- 80 tractor hours (i.e. the farmer uses 1 hour to plough approximately 3 acres of land).
- 50 tractor hours for sowing (i.e. 5 acres per hour);
- 40 tractor hours for spraying (i.e. 25 acres per hour and spraying is done 4 times for the crop's life time);
- 40 tractor hours for Fertilizer spreading (i.e. 25 acres per hour and spreading is done 3 times until the maturity of the crop;
- 60 machine hours for harvesting (i.e. approximately 4 acres per hour) and
- 50 machine hours for miscellaneous like straw collecting etc.

The crop takes 11 months from planting to harvesting and a total of approximately 320 machine hours. Two types of machines are used on the land – Fendt 516 Tractor and Claas 640 Harvester.

Fendt 516 Tractor

Claas Lexion 640 Harvester

Figure 6: Farm machineries

The Fendt 516 Tractor has a horsepower of 165 and has an inbuilt Selective Catalytic Reduction (SCR) for exhaust gas after treatment. The SCR technology helps the exhaust to be treated with AdBlue which converts nitrous oxide into nontoxic nitrogen and water. On the other hand, the Claas Lexion 640 Harvester has a horsepower of 640.

Multiplying this 320 machine hours by the emission rate/hour, this will be massive emission for an individual within a year. Putting the same argument at a macro level may affirm the saying that 'farmers are the second polluters in the country, after the motorists'.

Another potential environmental problem which my case study could face is the problem of pollution. The surrounding water (e.g. the river Shannon) can be polluted through runoffs of pollutants from the farm into the river thereby causing danger to the marine life.

I asked my case study host if there is an alternative way through which the farm activities could be carried out without the use of the 320 hours. He said *'No; I can't get away from the machine. The machine is the polluter. My production is intensive production. The only alternative is organic farming which is less intensive but I am not going to do that because I would not survive doing it'.*

4.2.5 Cost Benefits of Going Green

It was the intention of this researcher to use quantitative analysis in this section to proof to farmers that there is huge benefits of going green. However, due to the unwillingness of farmers to release some sensitive information, the below quantitative analyses have been inferred based on the available information.

The respondents were asked if they use green technology in their farm. As expected, 60% said 'no' while 40% said 'yes'. The next question I put to them was what will be their farming total cost in a year. The costs given ranges from €10,000 to more than €100,000 which can be represented in a graph as follows:

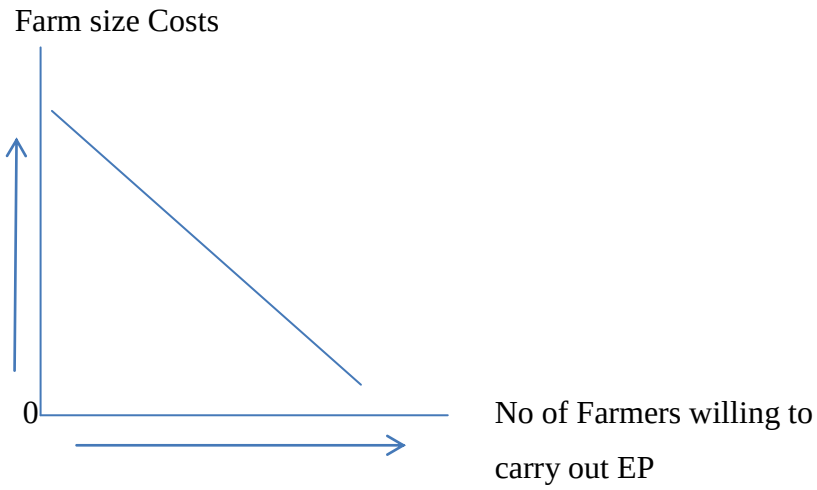

Figure 7: Relationship between farm size and environmental practices

As represented on the graph, the larger the farm size, the more expenditure incurred. Most of these expenditures are on non- environmental related activities. There is an inverse relationship between farm size and the use of more environmental practices due to the costs involved. The smaller the farm size and costs, the higher the number of farmers willing to carry out more environmental practices on their farms.

Adopting green technology in order to reduce climate change and at the same time earning a margin may be the way to go; but the hearts and minds of farmers have to be won if this has to be successful. To find out, I asked the respondents if they would be willing to adopt green technology on their farm. It was a 50/50 split. 50% said 'yes' while the remaining 50% were either 'no' or 'not sure'. In order to find out the reason why they chose the answer to the above question as they did, I asked the respondents an open ended question to list as many as possible their challenges of adopting more environmental practices. The challenges listed included:

- Cost of implementation
- Labour requirement
- Viability
- Too much paperwork
- Time

- Rules and regulations
- Having all the farming land in one location.

Even though farmers do have these challenges, they are willing to adopt more environmental practices if such practices will put more money into their pockets; if it is affordable, and cost efficient. Respondents are also willing to adopt more environmental practices if there is greater education of the climate change facts and assistance from the authorities.

4.3 Other Comments / Suggestions

Several related views were put forward especially during the interviews which were mostly subjective and are worthwhile to the topic under discussion. At the end of each interview session, I asked the interviewee if there is any suggestion advising farmers to adopt more environmental practices:

One of the interviewees said '*Farmers should always bear in mind that the sector is always good as the week before. So if there is a major problem with the water quality through pollution, it is bad for the industry and bad for everybody. There is the responsibility for every farmer not to forget the bigger picture which ultimately is the price, dictated by demand. If something is done to destroy the demand, it will lead to a big damage to the industry which may take many years to recover from. Therefore adopting more environmental practices may not put more milk in your tank or give you more acres of land but will protect the price of your produce'.*

In another interview, the interviewee suggested that farmers should incorporate the basis of environmental issue and the science behind them. This will benefit their businesses particularly on land use policy including when they plough, how they plough, how deep they plough, how much organic matter they release, when they spread fertilizers, etc. Most of these will have financial benefits. Also farmers should gather animal manure and keep for next spring. This will be an extremely valuable resource for the next start.

One interesting suggestion made by an interviewee which is worth mentioning is that farmers should be encouraged to be slightly adventurous. It would be wise to engage farmers in a dialogue, stop telling them what to do and asking them for help.

Likewise, at the end of the questionnaire, I asked the respondents what can influence them to adopt more environmental practices on their farm. The following were some of their comments:

- Affordability
- Environmental education
- IFA policy
- More grants

4.4 Data Evaluation

The aim of the research was to analyze and show to the Irish farmers the cost benefits of engaging in more environmental practices since it is on record that in Ireland, farmers are the second polluters of the environment after the motorists. Despite the lack of knowledge on the concepts of Greenhouse Gas emission, as up to 60% of the respondents either don't know or somewhat know the concept of GHG emission, it is fair to say that more farmers are prepared to adopt green technology. 70% of those surveyed indicated that they would use green technology on their farms if given the support.

Farmers are primary producers, substantial exporters and big contributors to the economy. Up to 90% of agricultural produce are exported. Farmers can still maintain or improve from the current level to higher height if they engage in green technology. With the use of green technology on their farms, there will be reduction on farming costs in the long run; reduction in pollution and GHG emission and with these reductions, farmers will reap the benefits. As only 1% of Irish products are grown organically, and there is huge demand for organic products both at home and abroad, adopting green technology will increase organic yields and profits which will benefit the farmers and the country as a whole.

4.5 Results Discussion

With no knowledge in agriculture and not coming from an agricultural background, this research was a learning curve tome as well. The information gathered both from the survey and interviews are mostly subjective in nature.

My interest on the research topic is as a result of the fact that on the economy front, Ireland is turning the corner after a prolonged and painful recession. Agriculture did contribute immensely to the recovery of the economy. On the flip side of the coin, climate change is deteriorating in an alarming rate. Agriculture again contributing hugely to the negative effect of climate change, for it is the second polluter of the environment with 32% after the motorists. It is this paradoxical relationship that prompted me to undertake this research and to show to the Irish farmers that there are cost benefits of engaging in more environmental practices while maintaining or increasing their margin.

The objectives of this research were:

- To identify government policies and opportunities that exist to farmers on addressing environmental issues
- To establish the problems faced by farmers on addressing environmental issues
- To identify the costs faced by farmers on addressing environmental issues
- To establish the costs benefit effect to farmers on adopting environmental practices
- To make suggestions on some actions appropriate to addressing environmental issues by farmers.

Land is not an easy thing to manage. We do need food and it is obvious that farmers do not pollute the environment deliberately. The difficulty is that there are a number of activities happening in farming that have a pollutant effect; for example the effects of GHG emission. Agriculture produces a lot of greenhouse gases which is partly due to the types of animals' ruminant in the country. In addition the increase use of nitrogen fertilizers, the application of slurry on land and the runoffs of nitrogen and phosphate and other materials into the water system causes wildlife problems as well as reduction

in water quality. Also, every cow produces GHG which also pollutes the environment. Milk quarters have gone up which implies more cows. Increasing stock number of cows on farms will also result to an increase in GHG gas emission.

Another activity which farmers do carry out that pollutes the environment is the reduction in biodiversity which may be as a result of the more intensified monoculture agricultural system over the last number of years. There is also the problem with the machine used in spreading the slurry. Even though it is now illegal to use the spreader that flashes the slurry upwards, it hasn't taken away the problem of air pollution and it is even worse if the slurry is spread close to a river because some may end up into the river course.

It was difficult to get a case study for livestock farming. However from the interviews and survey carried out, though subjective in nature, complex as it is and not scientifically proven, one can deduce that livestock farming pollutes the environment and emits GHG more than tillage farming. As one interviewee puts it *'Yes the livestock sector, in terms of GHG emission has a significant effect. There's a certain truth, as I understand, in what farmers and other organizations would say that pasture land are less polluting. However in tillage land, the ploughing of land also has its implication for the release of GHG. Application of fertilizers does have an effect as well. It is not as if one system is bad and the other is good'*.

In the attempt of reducing the effects of GHG emission and climate change and be able to attain the 20% target by 2020, government have come up with the Food Harvest 2020 program by using the 'Green brand'. Stricter policy measures are in place to control the activities of the farmers. The use of satellite to remotely inspect farm activities and sanctions (i.e. withdrawal of grants of up to 100% for a period of up to 2 years) are meted on those farmers who pollute the environment. However, for the department of agriculture to give green light to farmers with high yields to use extra nitrogen on their farms is not a wise move. The extra nitrogen may turn to be significant amount if put together and this is bad for the environment and also costly. As one interviewee said '*if you lower the level of inputs which the farmer apply, it may reduce emission and also farming costs'*. Government policies may not always be right. However, the intention of reducing the GHG emission, even though it is too ambitious, could be achieved if hearts and minds of farmers could be won and proper environmental education carried out.

Farmers are aware that their activities affect the environment negatively. However, the world's population has to be fed. The increase in population is putting more pressure on farmers to produce more food. This has an inverse relationship to the environment if current farming activities are to be maintained. There is the need to go green so that the inverse relationship could be converted to a direct correlation. Farmers are also concerned about the emission exerted into the environment as a result of their farm activities and are willing to adopt more environmental practices if given the support. This was echoed in the survey as 50% of the respondents showed interest of going green and up to 40% were not sure. With proper education and grants, I believe this 40% could be won into the 'yes' camp. For their main concerns to adopt green technology were affordability, environmental education and government policies.

The challenges which farmers could face in adopting green technology involves costs, urban/rural divide, lack of understanding, no adequate return in the short run, enhanced environmental legislation where farmers find themselves caught in the situation where they have no choice but to abide by it, run the farm in a very low margin in terms of the environment etc.

The benefits of adopting more environmental practices by Irish Farmers are enormous both to the farmers and the population. There is real demand and better price for sustainable products and only 1% of Irish products are organically grown when compared to other EU countries. Thus, Irish farmers are losing out on this. Other benefits derived from going green include increase efficiency use of fertilizer, reduction or elimination of pollution, costs reduction, good water quality to both human and marine life, good weather conditions and many more.

4.6 Conclusion

The primary data collected during this research have been analyzed in line with the themes in the literature review as well as the research objectives.

The first objective was to identify government policies and opportunities that exist to farmers on addressing environmental issues. It was evidenced that there is stricter control in place. Farmers are remotely monitored through the use of satellite, control on the level of nitrate use on their farms, control through the EU directives, control through grants – where grants are only given when farms meet the standards. As an interviewee said *'the only help we get from the government is control, control, control'*. However, it was seen that the policies are not well communicated to farmers as up to 60% of the respondents were either not aware of the policies at all or not aware of some of them. The opportunities that exist to farmers to address the environmental issues was evidenced in the giving of grants to purchase slurry equipment which is being used to make little trenches for more effective slurry use in the soil and for the reduction of air pollution; and also for the building of new tanks.

The second objective was to establish the problems faced by farmers on addressing environmental issues. Responses gotten from the survey revealed that farmers do face problems on going green. Variables such as cost of implementation, labour requirement, viability, too much paperwork, time, rules and regulations were indicated as the problems which farmers faced to adopt more environmental practices.

The third objective was to identify the costs faced by farmers on addressing environmental issues. As per the survey, the farmers indicated that the major costs were affordability of green technology, cost of implementation, the cost of bringing farm lands in one location, transportation cost and time.

The fourth objective was to establish the costs benefit effect to farmers on adopting environmental practices. The benefits of adopting more environmental practices by Irish Farmers are enormous both to the farmers and the population. There is real demand and better price for sustainable products and only 1% of Irish products are organically grown when compared to other EU countries. Thus, Irish farmers are losing out on this. Other benefits derived from going green include increase efficiency use of fertilizer,

reduction or elimination of pollution, costs reduction, good water quality to both human and marine life, good weather conditions etc..

In a nutshell, the vast majority of farmers want the world to be a better place. Education and dialogue could very much be the key rather than telling the farmers what to do. It is time for all parties to sit and have an honest assessment as to what the implications are and will be down the road, and how we can make it better; how can we reduce the level of pollution while still giving the farmers a good livelihood and thus provide us with the food we need.

5.0 Concluding thoughts on the contribution of this research, its Limitations and Suggestions for Further Research

In chapter 4, the findings of 55 survey responses, 5 interviews and a case study regarding the issues and challenges of adopting more environmental practices were discussed. In this chapter, the implications of the research objectives will be outlined and suggestions for further studies will be made.

5.1 Implications of Findings

The belief that farmers are the second polluters of the environment after the motorists which was evidenced in the literature review chapter was echoed in the findings. This was to a large extent attributed to lack of environmental education as over 50% of the respondents do not know or were not sure of the meaning of climate change. Knowledge exchange programs could be introduced for farmers to share ideas.

Even though there is strict control in place, most farmers do not implement government policies on climate change. There was evidence as per those surveyed that climate change policies were imposed onto farmers rather than having a dialogue with farmers to look for ways in combating the greenhouse gas emission.

It was evidenced that government approach towards helping farmers to adopt green technology was too weighted towards the export of commodities processed products rather than taking an approach that will promote high value added green products that are sustainable.

Beef industry is not a profitable business but a high emission of GHG business. It will be a wise move if dairy and beef businesses could be amalgamated. This will reduce GHG emission significantly. Also, ecological agricultural practices could be done, for example planting trees on hedge row beside pasture lands, using the technology to access the different land types of the farmer and match the use of land to a very accurate assessment of what the output is.

There is the lack of organic grown products in the country. Such products are more sustainable and have a high demand. It would be good for the country if such produce could be promoted so that a premium price and a significant market could be gained.

The fact that farmers do not know how to calculate their carbon footprint is a call for concern as up to 80% of the respondents did testify that they have no knowledge of measuring their carbon footprint. The implication here is that lack of knowledge may give rise to slow implementation or adoption of more environmental practices.

In his book 'Essay on the Principle of Population' (1798), the Economist Thomas Malthus asserted that unless population growth is checked, there will be shortage of food to feed them. However, Malthus did not foresee alternative ways of food supply which we have today. In the same line of thinking, population is growing and farmers are under immense pressure to feed this growing population of the world. If farmers do not adopt more environmental practices on their farms for a green harvest and green environment, the world would be an unsuitable place for any living creature and this will be more costly

5.2 Contributions and Limitations of the Research

Everybody is talking about climate change and the effects on the ozone layer. But vast majority of people really don't know what these are all about. The value of this piece of work is immeasurable as it is useful to not only the Irish farmers but to every individual. Solving the problem of climate change should be a concern for each one of us because the benefits surpass the costs. As the saying goes 'your health is your wealth', good source of water, pollution free environment and beautiful sceneries are all good for our health and saving them from our non-environmental activities makes us healthier and wealthier. The study is particularly meaningful in creating awareness to Irish farmers as well as the rest of the world that adopting more environmental practices in whatever thing we do helps in solving the problem of emission to the environment.

This piece of work, just like everything in life has its limitations. The very first limitation is having access to the target audience. There are over 120 thousand

registered farmers in Ireland. Survey questionnaire was given to 100 farmers in the various agricultural shows I attended across the country, but only 55 replies were received. Case studies were to be done on both tillage and a livestock farm. However, it was not possible to get a livestock farmer who will grant me audience. It was very difficult as well to get experts on the ground for interview. So many emails and letters were posted but only 4 replies were received. Due to the number of farmers in the country, sampling more could have produced result that may be more reliable.

Since the main objective was to analyze and show to the Irish farmers the cost benefits of engaging in more environmental practices, it was to be done using different costs elements from the farmers on their non-environmental activities and comparing them with costs of adopting more environmental activities. However, having access to this information was impossible.

Finally, time was the ultimate constraint.

5.3 Recommendations for Future Research

A large sample size could provide a better cost benefits analysis. Therefore, it is recommended that future research should obtain a larger sample size. Due to time constraint, surveys, interviews and case study were done at the same time. I will recommend that for future research, each item could be done at a different time so that the results are analyzed before embarking on the other. This would give a better result because issues that come up from one could be dealt with in the other.

I would also recommend that case studies for both tillage and livestock farms are carried out over a period and scientifically test both activities to find out which emits more GHG.

5.4 Final Conclusion

Chapter 5 demonstrated how the various data collected were used in answering and analyzing my research objectives as well as making recommendations for future studies. As someone who has no agricultural background, this piece of work has increased my knowledge in agriculture and the environment. It has also increased my analytical skills as I intend to continue one step further to PhD level with similar research topic.

'Achievement is willingness and determination'

References

BusinessDictionary.com, 2014. What is cost benefit analysis (CBA)? definition and meaning [WWW Document]. BusinessDictionary.com. URL http://www.businessdictionary.com/definition/cost-benefit-analysis-CBA.html (accessed 12.17.14).

Central Statistics Office, 2015. Quarterly National Accounts - Quarter 4 2014 and Year 2014 (Preliminary).

Ciara Kirrane, 2013. Climate Change could cost Irish Agriculture up to €2 billion » Latest News [WWW Document]. Stop Clim. Chaos. URL http://www.stopclimatechaos.ie/news/2013/10/24/climate-change-could-cost-irish-agriculture-up-to-2-billion/ (accessed 12.9.14).

Collins, L., 2007. Environmental Rights for the Future? Intergenerational Equity in the EU. Rev. Eur. Community Int. Environ. Law 16, 321–331. doi:10.1111/j.1467-9388.2007.00568.x

Collis, J., Hussey, R., 2003. Business research: a practical guide for undergraduate and postgraduate students. Palgrave Macmillan, Houndmills, Basingstoke, Hampshire; New York.

Connolly, J., Prothero, A., 2008. Green Consumption Life-politics, risk and contradictions. J. Consum. Cult. 8, 117–145. doi:10.1177/1469540507086422

Dasgupta, P., 2014. Pricing climate change. Polit. Philos. Econ. 13, 394–416. doi:10.1177/1470594X14541521

Department of Agriculture, 2009. Environmental Sustainability. Dept of Agriculture Ireland.

E. KATUNGI, D. KARANJA, D. WOZEMBA, T. MUTUOKI, J.C. RUBYOGO, 2011. A COST-BENEFIT ANALYSIS OF FARMER BASED SEED PRODUCTION FOR COMMON BEAN IN KENYA.

Eleanor Denny, 2007. A Cost Benefit Analysis of Wind Power.

(EPA), E.P.A., 2015. Visualising Ireland's Greenhouse Gas Emissions [WWW Document]. Environ. Prot. Agency EPA. URL http://www.epa.ie/climate/communicatingclimatescience/whatisclimatechange/visualisingirelandsgreenhousegasemissions/#.VOn1bizB3Dc (accessed 2.22.15).

Fayesoni, 2013. environmental issues [WWW Document]. StudyMode. URL http://www.studymode.com/essays/Environmental-Issues-39304918.html (accessed 12.10.14).

Fullen, M.A., 2003. Soil erosion and conservation in northern Europe. Prog. Phys. Geogr. 27, 331–358. doi:10.1191/0309133303pp385ra

Gemma O'Reilly, Phillip O'Brien, Frank McGovern, 2012. Addressing Climate Change Challenges in Ireland.

Hassanein, N., Kloppenburg Jr., J.R., 1995. Where the Grass Grows Again: Knowledge Exchange in the Sustainable Agriculture Movement. Rural Sociol. 60, 721–740.

IPCC Fourth Report, 2010. Measuring Climate Change.

Just, R.E., Antle, J.M., 1990. Interactions between agricultural and environmental policies: A... Am. Econ. Rev. 80, 197.

NASA, 2015. Climate Change: Vital Signs of the Planet: Evidence [WWW Document]. URL http://climate.nasa.gov/evidence/ (accessed 2.28.15).

Naylor, R.L., 2006. Environmental Safeguards for Open-Ocean Aquaculture. Issues Sci. Technol. 22, 53–58.

Nick Hanley, Clive L. Spash, 1993. Cost-Benefit Analysis and the Environment.

Nino Florencia Soto, 2014. United Nations and Climate Change. UN Clim. Change.

Pruneau, D., Kerry, J., Mallet, M.-A., Freiman, V., Langis, J., Laroche, A.-M., Evichnevetski, E., Deguire, P., Therrien, J., Lang, M., Barbier, P.-Y., 2012. The competencies demonstrated by farmers while adapting to climate change. Int. Res. Geogr. Environ. Educ. 21, 247–259. doi:10.1080/10382046.2012.698085

Sarkar, A.N., 2011. Global Climate Governance: Emerging Policy Issues and Future Organisational Landscapes. Int. J. Bus. Insights Transform. 4, 67–84.

Saunders, M., Lewis, P., Thornhill, A., 2007. Research methods for business students, 4th ed. Financial Times/Prentice Hall, Harlow, England; New York.

Stuart, D., Schewe, R.L., McDermott, M., 2012. Responding to Climate Change Barriers to Reflexive Modernization in U.S. Agriculture. Organ. Environ. 25, 308–327. doi:10.1177/1086026612456536

THE STATIONERY OFFICE, 2014. EUROPEAN UNION (GOOD AGRICULTURAL PRACTICE FOR PROTECTION OF WATERS) REGULATIONS 2014.

Thia Hennessy, Cathal Buckley, Michael Cushion, Anne Kinsella, Brian Moran, 2011. National Farm Survey of Manure Application and Storage Practices on Irish Farms.

Vandenabeele, J., Wildemeersch, D., 2012. How Farmers Learn About Environmental Issues: Reflections on a Sociobiographical Approach. Adult Educ. Q. 62, 56–72. doi:10.1177/0741713610392770

Wordpress, 2014. Carbon Lock-in [WWW Document]. One- Irel. URL http://oneoffireland.wordpress.com/ (accessed 12.9.14).

World Business Council for Sustainable Development, 2008. Going green costs less than you think. J. Prop. Manag. 73, 7–7.

Appendix A: Questionnaire

ENVIRONMENTAL PRACTICES & COST BENEFITS SURVEY

Dear Respondent, thank you for participating on this survey. I am a post graduate student in Griffith College Dublin preparing my dissertation on the topic "Insight into the issues and challenges of adopting more environmental practices on Irish farms" as part of the award of an MSc degree in Accounting and Finance. All responses provided on this questionnaire would be treated with strict confidence and would only be used for the purposes of my dissertation. Nowhere in the survey would you be asked to give personal information regarding your identity or that of any relative.

Please I would appreciate it if you could provide honest answers to the questions so that the researcher would be able to draw a credible conclusion as to the costs and benefits of adopting more environmental practices on Irish farms.

A) Profile of the respondent

1. Are you □Male □Female?
2. Age range (please tick one) □ <20yrs □20 – 29yrs □30 – 39yrs
   □40 - 49yrs □50 – 59yrs □60 – 69ys □ ≥70

B) Farmers Education and approach to and Communication of climate change policies

1. Do you understand the meaning of climate change? □Yes □No □Not Sure
2. Do you believe in climate change? □Yes □No
3. Are you aware of government policies on climate change? □Yes □No
   □Not sure □Some of them but not all □Not interested because I don't believe in climate change.
4. Do you implement government policies on climate change? □Yes □No
5. If not 'Yes' in questions 2, 3 and 4 above, are you willing to learn about climate change and implement government policies on climate change? □Yes □No □Somewhat □Not sure
6. Are climate change policies well communicated to you? □Yes □No
7. Do you receive any support from the government in implementing climate change policies? □Yes □No
8. Would you be happy and willing to participate in a knowledge exchange program on climate change and good environmental farm practices between farmers? □Yes □No □Not sure
9. Overall, how would you rate your understanding of climate change and the policies provided by the government? □Very adequate □Adequate □Neither adequate nor inadequate □Inadequate □Very Inadequate

C) Agricultural practices, Greenhouse gas emission and Measuring CO2

1. Do you know or understand the concept of Greenhouse Gas (GHG) emission? □ Yes □No □Somewhat
2. It is on record that farmers in this country are the second polluters of the environment after the motorists. Are you aware or believe that your farming

practices contribute negatively to Greenhouse Gas (GHG) emission? □Yes □No □Not sure □Somewhat

3. Would you be concerned that the emission is depleting the ozone layer and causing climate change? □Yes □No

4. Would you be prepared to adopt more environmental practices (e.g green technology, etc) on your farm? □Yes, I'm already practicing □Yes, if given the support □Yes, regardless of any support □No □Not sure

5. Do you know how your carbon footprint is calculated or measured? □Yes □No □Not sure □Somewhat

6. Would you be prepared to reduce your carbon footprint if you are aware or know its damage to the environment? □Yes □No □Not sure □Somewhat

7. Overall how would you rate your farm practices towards the environment? □Adequate use of green technology □Happy with my old method because it's costly changing □Neither adequate nor inadequate □Don't care about climate change □Inadequate □Will be willing to change if grant is given and more profit made □Other, please specify

_____

D) Costs of not going green vs Costs of going green and challenges

1. What farm practice do you carry on your farm? □Livestock □Tillage □Other, please specify _____

2. Do you use green technology in your farm? □Yes □No

3. In a year what will be your farming total costs? □<€10,000
□€10,000 - €15,000 □€15,000 – €20,000 □€20,000 - €25,000
□€25,000 - €30,000 □€30,000 - €35,000 □€35,000 - €40,000
□€40,000 - €45,000 □€45,000 - €50,000 □€50,000 - €55,000
□€55,000 – €60,000 □€60,000 - €65,000 □€65,000 - €70,000
□€70,000 - €75,000 □€75,000 - €80,000 □€80,000 - €85,000
□€85,000 - €90,000 □€90,000 - €95,000 □€95,000 - €100,000 □ >€100,000

4. Do you receive any grants from the government towards these costs? □Yes □No

5. Do you believe that green technology is more beneficial and cost less in the long run? □Yes □No □Not sure

6. Would you be willing to adopt green technology on your farm? □Yes □No □Not sure

7. What would be your challenges of adopting more environmental practices? List as many as possible.

_____

_____

8. What can influence you to adopt more environmental practices on your farm?

_____

_____

If you are available for interview, please submit your contact details below:

Name_____ Phone number_____

Thank You

Appendix B: Questions to professionals

1. Do you believe in climate change?
2. It's on record that farmers are the second polluters of the environment, i.e. after the motorists. In your opinion what are these activities by farmers that pollute the environment?
3. Do you think the government is doing enough to remedy the situation? If not, why not?
4. Do you think, with proper education, farmers will be willing to adopt more environmental practices? Or will there be resistance?
5. What do you think will be the challenges by farmers for adopting more environmental practices
6. Is there any benefit?
7. Any suggestion or advice to farmers on the benefits to change farming practices? What can be done?